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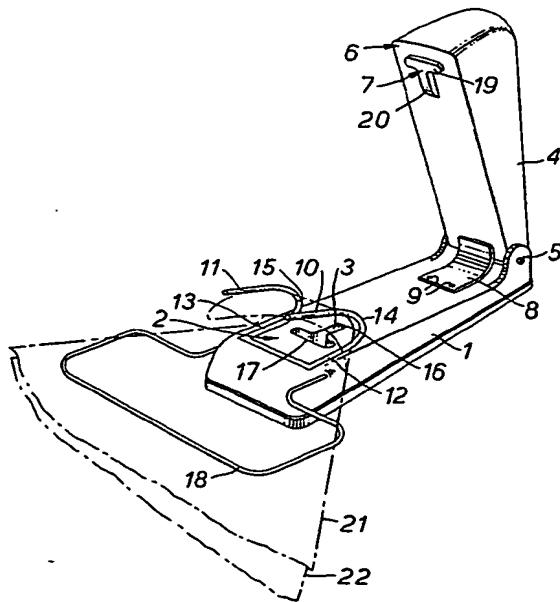
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(54) Apparatus for connecting together a plurality of webs of flexible material.

(57) An apparatus for connecting together a plurality of webs of flexible material comprises a base (1) having an anvil (2) with a sharp edged opening (3) therein. The opening (3) comprises a shank region (16) and an enlarged head region (17). A punching head (6) movable towards and away from the base (1) carries a punch (7) having a sharp edge and also comprising a shank region (20) and elongate head region (19) which are capable of fitting closely within the corresponding regions (16, 17) of the anvil opening (3). Either or both of the punch (7) and anvil opening (3) are devoid of a sharp edge adjacent that end of the respective shank region (20; 16) which is remote from the respective enlarged head region (19; 17). When two or more webs, (21, 22) are placed between the punch head (6) and the anvil (2), and the punch (7) is moved into the anvil opening (3), the sharp edges of the punch (7) and the opening (3) punch a portion of material having a shank and an enlarged head from each web (21, 22) and said portion remains joined at the base of said shank to the associated web. The apparatus may be manufactured in a hand-operated version as substitute for a stapling machine or in an industrial version possibly power operated and useful for example in attaching packets to display cards. In other embodiments the invention may be used for attaching together the ends of strapping extending around loads and for connecting together sets of sheets of paper formed from continuous runs of such paper.



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APPARATUS FOR CONNECTING TOGETHER A PLURALITY
OF WEBS OF FLEXIBLE MATERIAL

This invention relates to apparatus for connecting together a plurality of webs of flexible material.

There are many areas where webs of flexible material need to be connected together, some of these being the securing together of a number of sheets of paper, for example in office use, the securing of packets to display cards, the securing together of parts of folded blanks to form cartons and other containers and the fastening together of two ends of a length of strapping for packaging applications.

There are many well-known methods of securing together webs of flexible material. Perhaps stapling machines are the most common example, but these have drawbacks in that the staples can be difficult to remove from the stapled sheets, the machines require constant reloading and staples are not completely interchangeable from one machine to another.

Attempts have therefore been made to fasten two or more webs of flexible material together without the use of auxiliary fastening elements such as staples. U.K. Patent Specification No. 508.663 (Hahn) describes and illustrates an apparatus in which a V-shaped tongue is punched out of a corner of one web and is then automatically

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threaded into a slit automatically cut into the other web. Another device working on this same principle is disclosed in U.S. Patent Specification No. 1,065,904 (Bumps). Devices of this type are relatively complicated
5 in construction, they have many points of potential failure because they use a large number of working parts, and they are therefore relatively expensive and bulky: as a result, although they have been known for many years, they have so far failed to develop any permanent place
10 on the market.

U.K. Patent Specification No. 792,852 (Jewell) attempts to improve upon this slit-and-tongue type of fastener, and describes and illustrates an arrangement in which a basically circular tongue is punched through
15 the folded corner region of the webs which are to be joined together. The apparatus described and illustrated in this Specification No. 792,852 is undoubtedly far less complicated than apparatus of the 508,663 kind; but it has the drawback that the connected webs are relatively easily
20 separated from one another because the basically circular locking tab which is punched out of the webs allows the two webs to be all too easily rotated relative to one another so that the punched tab slides out of register with its co-operating circular slot.

25 Again, therefore, although the 792,852 device has been known for over twenty years, it has not - as far as

I am aware - made any impact on the market. In general, despite its admitted drawbacks, the basic stapling machine continues to dominate the commercial market.

According to the present
5 invention apparatus for connecting together a plurality
of webs of flexible material comprises a base; an anvil
incorporated in said base and having an opening therein, at
least part of the opening being defined by a first sharp
edge and said defined part comprising a shank region and an
10 enlarged head region; a punching head; means mounting said
punching head for movement towards and away from said base;
and a punch incorporated in said punching head, at least
part of said punch being delineated by a second sharp edge
and said delineated part comprising a shank region and an
15 elongated head region which are respectively capable of
fitting closely within said shank region and enlarged head
region of said defined part of the opening in said anvil; at
least one of said punch and said anvil opening being devoid
of a sharp edge adjacent that end of the respective shank
20 region which is remote from the respective enlarged head
region, whereby when said webs are placed between said punch
head and said anvil and said punch is moved into said anvil
opening said first and second sharp edges punch a portion
of material having a shank and an enlarged head from each
25 web and said portion remains joined at the base of said
shank to the associated web.

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To illustrate use of the apparatus if two sheets of paper are placed one on top of another, folded over at one corner to form four thicknesses and those four thicknesses are placed between the anvil opening and the 5 punch and are then punched, it will be found that when the punched sheets are withdrawn from the apparatus they will be attached to one another. If the folded corner is smoothed back after punching the sheets will still remain attached to one another by virtue of the engagement of 10 the enlarged heads of the punched portion engaging in the shank openings. The method is equally applicable to two sheets of flexible material other than paper, and also to more than two sheets of flexible material. If a substantial number of sheets are to be connected then 15 it is found that it will suffice to fold over the corner of, say, the two uppermost and two lowermost sheets and to punch through the folded parts and the remainder of the sheets simultaneously. The same connecting effect as with two sheets is then obtained.

In all these cases the sheets can easily be 20 separated from one another because only the punched portion holds them together. Furthermore, no materials other than the webs themselves are needed to maintain the connection, the use of separate fasteners such as staples being 25 avoided. The apparatus avoids the complexity of devices of the kind shown in U.K. Patent Specification No. 508,663

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whilst giving an altogether more positively-locked and less readily separated fastening than the apparatus of U.K. Patent Specification No. 792,852.

Apparatus in accordance with the present
5 invention may have uses other than simply connecting together superimposed pieces of paper or other material. For instance, the apparatus may be used for securing together the two ends of a length of strapping extending around a load. If the ends are brought
10 together so that they are under tension around the load, pieces punched out using the apparatus of the invention and then the tension released, the ends of the strapping will move relatively apart and the enlarged head portion from one end will engage in the
15 shank portion of the other end so that the strapping holds together in a secure condition. The use of apparatus in accordance with the invention in this way avoids the need for separate metal bands to surround the superimposed ends of the strapping and
20 for crimping to be applied to these metal bands.

Apparatus in accordance with the present
invention may also be used for securing packets to a
25 ^{the} display card, /packets containing, for instance,
peanuts or other goods. The packets are laid over the
display card and then the apparatus used to punch
out pieces from both the packets and the display
card. The packets remain attached to the display
card because of the engagement of the enlarged head
portion to the punched out pieces of one of the
30 packet and the display card with the shank portions of
the other of the packet and the display card.

Apparatus in accordance with the present
invention may also be used to join together two or
more pieces of paper without the necessity for folding

over the corners of the pieces of paper. For example apparatus in accordance with the present invention may be used to join together a plurality of sheets of paper, each sheet of paper being in the form of so-called continuous paper having transverse perforations extending across the width of the paper at spaced-apart intervals therealong. Such paper is, for instance, widely used on printers used in many businesses, for instance, printers forming part of a computer. Such sheets of paper often having holes extending along one or both margins thereof at intervals of, say, about $\frac{1}{4}$ to $\frac{1}{2}$ ". These holes are for engagement with peripherally spaced-apart lugs on one or more rollers of the printer.

It may be desired to form from two or more lengths of such paper, sets of two or more individual sheets. For instance, it may be desired to form sets of upwards of two sheets, being a top sheet and copy sheets. In order to do this the continuous lengths have to be overlaid and the overlaid lengths then have to be separated transversely, either along their perforations or, if no perforations are provided, the overlaid sheets have to be cut at appropriate spaced-apart positions. However, the result would then be that the sheets of each set of sheets are not connected to the remaining members of the set. However, apparatus in accordance with the present invention allows the sheets to be connected together in a simple way, the connection together being, if desired, incorporated in a continuous process for bringing together the long lengths of paper and dividing them at a subsequent station or stations.

When the continuous lengths of paper are brought together correct superimposition is ensured by

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feeding them in such a way that the closely spaced-apart marginal holes engage with the pins or lugs on the feed rollers. Normally each sheet will be precisely superimposed so that, when perforations are 5 provided, these exactly overlie each other. However, with the present invention, the apparatus is such that either the bottom or the top sheet is displaced relative to the other sheet or sheets. This displacement may be by one marginal hole. After the 10 continuous sheets have come together in this way, apparatus in accordance with the present invention is used to punch out a hole at a position between each adjacent pair of perforations (in the case where the sheets have perforations or between each 15 adjacent position where the sheets are to be cut where there are no perforations). This hole is punched through each superimposed sheet of paper at a position which may be, for instance, close to one or more of the afore-mentioned marginal holes. As 20 before, the pieces of paper which are punched out remain attached to the corresponding sheets of paper at the bottom of the shank portions thereof.

Subsequently the superimposed continuous sheets of paper are fed to a further roller where these 25 continuous sheets of paper are loaded onto the pins of the further roller in such a way that the previously displaced piece of paper is brought into exact alignment with the other sheet or sheets of paper. Thus the displaced sheet moves relatively to the other sheet or sheets and in so doing the same sort 30 of engagement between the head portion of the punched out piece from one sheet takes place with the shank portion of the other or other sheets. As a result, the continuous sheets of paper are connected together

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at positions along their lengths. Subsequent division of these continuous sheets of paper along transverse perforations or by cutting result in sets of sheets of paper, each set having the members thereof connected 5 together.

The apparatus may further comprise guide means operative, as part of said webs advance into said apparatus, to fold said advancing parts back over the remainder of said webs and to position said folded-back parts and part of the remainder of said webs over 10 said anvil opening.

In one form of the apparatus the mounting means comprises a pivotal connection between said base and said punching head located remote from said anvil 15 opening and punch. In an alternative form the mounting means comprises guiding means for guiding said punching head along a reciprocal path towards and away from said base. In either case bias means may be provided for biasing the punching head away 20 from the base so that the punching action takes place against the biasing force. The apparatus may be constructed in various forms ranging from light-weight hand-held devices designated for office use 25 to power operated multi-anvil devices for industrial use.

In another form of apparatus in accordance with the present invention, the apparatus comprises a base, a punching head slidable relative to the base, a handle mounted on the base for pivotal movement 30 relative thereto and a folding mechanism mounted on the base for pivotal movement thereto, the handle, punching head and folding mechanism being operably connected together so that movement of the handle causes both the folding mechanism and the punching 35 head to effect their pivotal movements.

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- The form of the defined part of the anvil opening and the delineated part of the punch is not critical as long as each has a respective shank region and enlarged head region. These combined regions could
- 5 alternatively be described as a generally T-shaped slot and the punch shape includes all forms from a true T-shape through a key-hole shape to a triangular shape of which the narrow part can be considered a stem and the broader part an enlarged head.
- 10 The invention will be better understood from the following description of certain specific embodiments thereof, given, by way of example only, in connection with the accompanying drawings in which:-
- 15 Figure 1 is a perspective view of a first form of apparatus according to the invention;
- Figure 2 is a side elevation of the apparatus shown in Figure 1;
- 20 Figure 3 shows, in views A to E plan views of five different anvils that may be used in the practice of the invention;
- Figures 4 and 5 show respectively partial longitudinal cross-sections through alternative punch and anvil forms;
- 25 Figure 6 illustrates in partial schematic plan view use of an alternative form of apparatus according to the invention in attaching packets to display cards;
- Figure 7 is a cross-section on the line VII-VII of Figure 6;
- 30 Figure 8 is a vertical longitudinal section through another embodiment in accordance with the present invention;
- Figure 9 is another longitudinal vertical section through the embodiment shown in Figure 8 but with the

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handle in its lowered position;

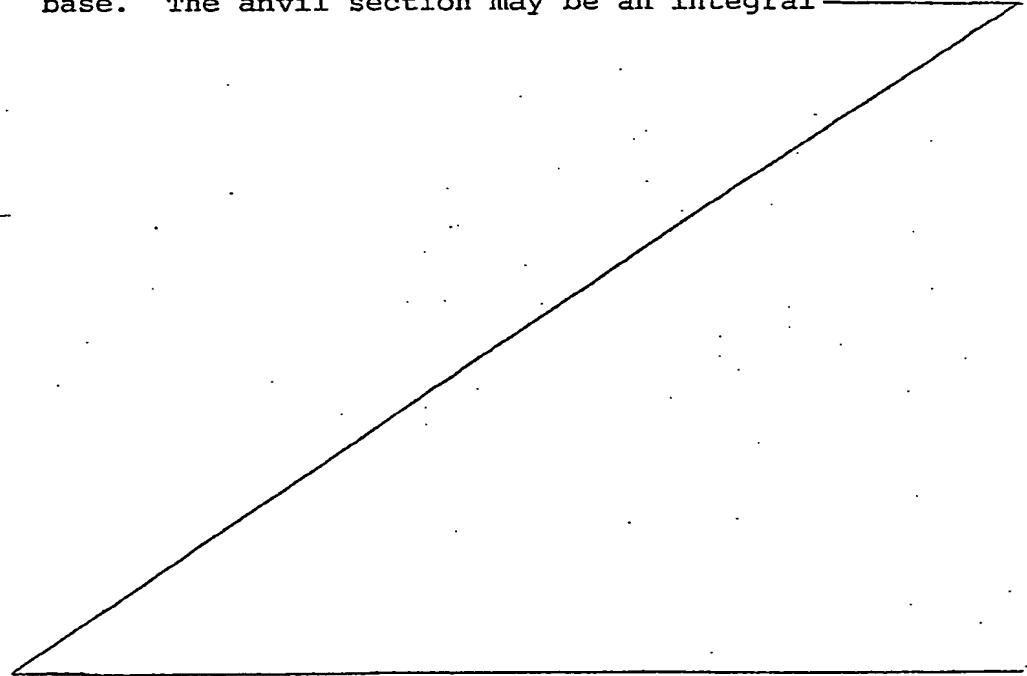
Figure 10 is a cross-section on the line TT of Figure 8;

Figure 11 shows the anvil member of the embodiment 5 of Figure 8;

Figure 12 is a front elevation of part of the folder guide with the folder in its up position; and

Figure 13 is similar to Figure 12 but with the folder in its down position.

10 Referring now to Figures 1 and 2, these show a form of the apparatus designed for light office use. The apparatus consists of a metal base, which may be rubber-faced on its underside to give a non-slip standing surface. The top side of the base
15 incorporates a hard steel anvil section 2 having a T-shaped slot 3 formed therein. The slot may be of limited depth or may extend completely through the base. The anvil section may be an integral



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part of the base or may be a separate insert into the material of the base and secured thereto by adhesive, screws or any other suitable means.

An elongate arm 4 is pivotally mounted at one end 5 to the base about pivot pins such as 5. The arm has a punching head section 6 which may be integral with the arm or a separate part secured to the arm. The punching head section has incorporated therein a punch 7 which is again substantially T-shaped. A leaf spring 8 is secured 10 to the base 1 by rivets 9 and is bent so that its free end engages the underside of the elongate arm 4 in order to bias that arm away from the base.

Two substantially U-shaped resilient wire guides 10 and 11 project upwardly from the base and are located one 15 to each side of the anvil opening 3. Each guide has a lower part 12, 13 respectively which is located in a groove in the upper surface of the base 1 and held within the groove by, for example, a suitable adhesive. The bight 14, 15 respectively of each wire guide is located beyond 20 the end 16 of the anvil opening 3. The free ends of the upper parts of the wire guides lie ahead of the opposite end 17 of the anvil opening. A further rectangular wire guide 18 projects forwardly from the base and in front of the guides 10 and 11, the ends of the guide 18 again being received in recesses within the base 1 and being secured 25 thereto by a suitable adhesive or other means.

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- The form of the anvil opening 3 and the punch 7 is clearly seen from Figure 1. The whole of the opening is defined by a first sharp edge and comprises a shank region terminating at the end 16 and an enlarged head region
- 5 terminating at the end 17, the whole being of substantially T-shape. The anvil opening and the punch are of substantially the same shape and the punch projects a given distance from the punching head and terminates in a web-contacting surface 19. A first part of the web-contacting surface
- 10 is delineated by a second sharp edge and comprises the enlarged head region and that part of the shank region which is closest to the enlarged head region. A second part 20 of the web-contacting surface forms an extension from the shank region and tapers away from the first part
- 15 of that surface towards the punching head. The tapered part of the surface blends smoothly into the remainder of the shank and the junction between the two is not sharp. The whole of the punch 7 is capable of fitting closely within the anvil opening 3.
- 20 To use the apparatus to connect together two sheets of paper the sheets 21, 22 are placed one on top of the other and one corner of the combined sheets is then fed into the opening in the guide 18 from below the guide and into and around the guides 10 and 11 so that the corner will automatically be folded back on itself to
- 25 the position shown in the drawings. Eventually the shape

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of the guide 18 will prevent the sheets of paper from being fed any further forward into the apparatus. The punching head can then be brought down onto the anvil against the action of the leaf spring 8. Four thicknesses 5 of paper will be punched from the two folded over sheets and the punched T-shaped portions will be pushed through the sheets but will not be separated from them. Thus, the shank of each punched portion remains joined to the associated sheet due to the presence of the tapered 10 section 20 of the punch and the fact that this does not include a sharp cutting edge transversely of the shank.

When the sheets are subsequently withdrawn from the apparatus, they will be found to be secured together at the folded corner. If the fold is opened out, the two 15 sheets will stay secured to one another, with the enlarged head portions engaging behind the cut-out shank portions of the sheets.

Figure 3 shows a series of anvils having different shaped openings, each of which may be used with a 20 correspondingly shaped punch in apparatus of the invention. The anvil A has a T-shaped opening which corresponds substantially to the opening shown in the apparatus of Figures 1 and 2. Anvil B has an opening which tends more towards a key-hole shape and also has a shank region and 25 an enlarged head region. Anvil C has a triangular opening, which can be considered as having a stem comprising the

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narrower part 23 of the triangle and an enlarged head comprising the broader part 24 of the triangle. Anvil D has two openings 25 and 26 arranged side by side each of miniature key-hole form. Anvil E has a larger opening 5 comprising a shank 27 and an enlarged square head 28. This latter anvil may be particularly useful in apparatus for securing together the two ends of a length of strapping extending around a load. If the ends are brought together and are punched on the anvil E with a punch head of the 10 same shape, the shank of the punch tapering into the punch head as already described, then squares of the strapping material each secured to the material by a shank will be punched from the material. If tension in the strapping is then released the ends of the strapping will move 15 relatively and the square heads will engage behind the slots so holding the strapping in a secure condition.

The apparatus shown in Figures 1 and 2 ensures that the punched portions of material remain attached to the main body of the material by tapering the punch head as 20 at 20 so that the shank of material is not cut through. This result may be achieved alternatively by adopting either of the constructions shown in Figures 4 and 5. Each of these Figures shows a base 29 including an anvil opening 30 of substantially T-shape. A punching head 31 is positioned 25 above the base and carries a substantially T-shaped punch 32. The whole of the punch is delineated by a sharp edge.

In each case the anvil opening includes an extension 33 of the shank region beyond the end 34 of the shank region of the punch so that as that end enters the anvil opening there is no cutting effect on material laid between the 5 punch and the anvil. The arrangement shown in Figures 4 and 5 differ only in that in the Figure 4 arrangement the extension 33 of the shank section tapers upwardly to meet the upper surface of the base, while in the Figure 5 embodiment no such taper is included.

10 Figures 6 and 7 show schematically a form of apparatus that may be used for securing packets to a display card. The apparatus comprises a base 35 in which are incorporated a plurality of anvils each having an anvil opening 36 of generally key-hole form. Four guide 15 pillars 37 extend upwardly from the base and guide thereon a punch carrier 38 supported above the base. Compression springs 39 may surround each of the pillars 37 to bias the carriers away from the base. The carrier 38 carries a punching head 40 which on its lower surface has a plurality 20 of key-hole shaped punches 41, each arranged to engage within a respective one of the anvil openings 36. Each punch 41 has an enlarged head and a shank, both delineated by a sharp edge, and a shank extension 41a which tapers smoothly to meet the punching head, so that as the punch 25 engages the anvil opening a key-hole-shaped piece of material is punched out but is left attached to the

remainder of the material as already described. A display card 42 with its front side uppermost is fed into the apparatus and packets such as 43 are provided to be secured to the card. The drawing shows two packets to be attached to the card side by side in a series of rows but it will of course be appreciated that by proper choice of anvil and punches a greater number of packets can be attached. Each packet is laid on the card with its front side downwards and with its upper edge folded over as at 44 to give a double thickness, a strip of card 45 being folded around the folded edge of the packet as best seen from Figure 7. With the packets and card strip arranged as shown in this Figure the punch carrier is lowered towards the base either manually or under power and the punches punch through the two thicknesses of strip 45, two thicknesses of packet 44 and single thickness of display card 42. The card may then be advanced in the direction of the arrow shown in Figure 6 and a further two packets placed on the card in the positions outlined by the broken lines 46, whereupon the punching operation may be completed. When the required number of packets have been punched to the card in this way the card is taken from the apparatus and can be used for display with the edge 47 of the card uppermost, the

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packets falling and unfolding to lie adjacent the card with the strip 45 uppermost. The packets may then be pulled individually from the card as required.

It will be understood that, rather than attach
5 packets to the card one row at a time as described
with reference to Figures 6 and 7 a larger form of the
apparatus may be constructed designed to punch a
plurality of packets in each of a plurality of rows to
the card simultaneously.

10 Referring to Figures 8 to 13, another embodiment
of apparatus in accordance with the present invention,
particularly light apparatus for office type use,
includes a base 51 within which a punch 55 is mounted
for slidable longitudinal movement within guide 53.
15 The front end 57 of punch 55 carries key-hole shaped
punch members (not shown), each punch member having
an enlarged head and shank, both delineated by a
sharp edge and a shank extension which, as is the
case with the previously described embodiment, tapers
20 smoothly to meet at the punch head 57.

An anvil 59, in the form of a die plate, is
located forwardly of the punch and fixed to the
base or to an extension of guide 53 by rivets or the
like through fixing holes 61. As will be described
25 below, punch 55 can be slidably moved from a first
position shown in Figure 8 to a second position,
shown in Figure 9, in which the punch members on the
head 57 of the punch 55 pass through anvil openings
63. Each anvil opening 63 has a shank and an
30 enlarged head portion matching the shape of the above-
mentioned punch members.

Attached by means of rivets (not shown) to base
51 are upwardly extending side plates 67. Extending
through side plates 67 at a forward upper position

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thereof is a pin 69 on which is mounted for pivotal movement thereon a handle 71. As can best be seen in Figure 8, handle 71 extends rearwardly from pin 69 terminating at a position above the rear end of base 5 51. Handle 71 is shown in its rest position in Figure 8 but downward pressure applied to the rear end of handle 71 will cause it to move from the position shown in Figure 8 to the position shown in Figure 9.

Connecting levers 73 and 75 are each mounted at 10 one end thereof for pivotal movement on a pin 77. Pin 77 is fixed at each end to handle 71. Connecting levers 73 and 75 terminate at their other end at a pin 79 on which they are pivotally mounted. Also 15 pivotally mounted on pin 79 and located inwardly of connecting levers 73 and 75 are operating levers 80 and 81. These operating levers extend upwardly from pin 79 to a further pin 82 on which they are also pivotally mounted. Pin 82 is fixed at each end to side plates 67. Operating levers 80 and 81 extend 20 downwardly from pin 79 to the rear end of punch 55 on which they are again pivotally mounted.

Pin 79 also passes through a slot 83 of folder control plate 87. As can be seen in Figure 10, folder control plate 87 is located centrally between 25 the pair of operating levers 80 and 81 and, outwardly of the latter, the pair of connecting levers 73 and 75. The shape of folder control plate 87 can best be seen in Figures 8 and 9. It is roughly rectangular in shape with, at its front end, neck portion 89 and head portion 91. At its rear end it 30 is mounted for pivotal movement on pin 93, the latter being fixed at each end to side plates 67.

Surrounding a substantial area of the front portion of each side plate 67 is a channel section

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bracket 95. The central bight section 97 of bracket 95 extends transversely across the front of the side plate 67 there being a small gap 99 between bight section 97 and the front edges of side plate 67.

5 Mounted for sliding movement within this gap is folder 101. Folder 101 is substantially rectangular in shape but has a lower central cut out portion 103 and an upper substantially square shaped hole 105 through which extends the head portion 91 of folder

10 control plate 87.

A tension spring 104 is fastened at one end to the rear of punch 55 and at its other end to the back of guide 53 within base 51.

In order to connect together two or more pieces
15 of paper using the above-described device, the superimposed pieces of paper 105 are fed over the front of base 51 and below the bottom forward end of handle 71 and folder 101 to the position shown in Figure 8 where the corners of the superimposed pieces
20 of paper 105 abut against the side plates 67. Handle 71 is then depressed. Handle 71 is linked to pin 79 by way of connecting levers 73 and 75 and as a result of the downward movement of handle 71 pin 79 is caused to move in a substantially horizontal forward direction.

25 As a result of this movement and of the location of pin 79 within slot 83 of folder control plate 87. the latter is caused initially to pivot upwardly about pin 93. This is because of the downward travel of the first upwardly extending arm of inverted

30 V-shaped slot 83 during the forward movement of pin 79. After pin 79 has reached the apex of the V-shaped slot 83, further forward movement of pin 79 causes the folder control plate to reverse the direction of its pivotal movement about pin 93 and move upwardly.

Accordingly depression of handle 71 from the position shown in Figure 8 to the position shown in Figure 9 causes movement of folder 101 first downwardly and then upwardly as a result of the engagement of head portion 91 within square shaped slot 105 of folder 101.

- 5 portion 91 within square shaped slot 105 of folder 101.
- In an alternative embodiment the forward downwardly extending portion of slot 83 may be replaced by a forward horizontally extending portion. In this
- 10 case the movement of the folder, as a result of depression of the handle, is only in a downwards direction. This downward movement continues until the pin reaches the centre of the slot and then further downward movement of handle 71 does not result in any
- 15 change of position of the folder. It has, however, been found that neater, more effective results are obtained when the folder returns to its up position after effecting folding of the sheets of paper.

- During its downward movement, the bottom edges of
- 20 folder 101 engage papers 105 to fold them at the corners thereof to the approximate confirmation shown in Figure 9, although Figure 9 shows the situation after the folder has returned to its up position and the papers have been engaged by punch 55.

- 25 The above-mentioned forward movement of the pin 79 also effects forward movement of operating levers 80 and 81 about pin 82. Because operating levers 80 and 81 are connected at their lower ends to punch 55 this effects in turn forward movement of punch 55.
- 30 This forward movement continues during the whole of the downward movement of handle 71 and the head 57 of punch 55 engages the folded papers 105 just as the folder 101 is beginning its return upward movement. Subsequent forward movement of punch 55 results in

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punch members pressing the folder papers against anvil plate 59 and then passing through the layers of papers and through the anvil openings 63. The punched out pieces of paper remain attached to the sheets 105 at 5 the bottom of the shank portions of the punched out pieces because of the rearward tapering of the shank extensions of the punch members. The punched out pieces are otherwise pushed through the anvil openings to a forward position thereof.

10 Release of the downward pressure on handle 71 allows the tension spring 104 to return to its original position thereby returning punch 55, operating levers 80 and 81, folder control plate 87 (carrying with it folder 101), connecting levers 73 and 75 and handle 15 71 back to their original positions. The sheets of paper 105 can then be removed. On unfolding them, they are found to be secured together because of the engagement of the enlarged head portions from the pieces cut out nearest to the corners of the sheets of 20 paper 105 with the shank portions of the pieces cut out from positions further from said corners. In effect the sheets of paper 105 are "stitched" together by the punched out pieces when said sheets are unfolded.

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CLAIMS:-

1. Apparatus for connecting together a plurality of webs of flexible material, said apparatus comprising a base; an anvil incorporated in said base and having an opening therein, at least part of the opening being defined by a first sharp edge and said defined part comprising a shank region and an enlarged head region; a punching head; means mounting said punching head for movement towards and away from said base; and a punch incorporated in said punching head, at least part of said punch being delineated by a second sharp edge and said delineated part comprising a shank region and an elongated head region which are respectively capable of fitting closely within said shank region and enlarged head region of said defined part of the opening in said anvil; at least one of said punch and said anvil opening being devoid of a sharp edge adjacent that end of the respective shank region which is remote from the respective enlarged head region, whereby when said webs are placed between said punch head and said anvil and said punch is moved into said anvil opening said first and second sharp edges punch a portion of material having a shank and an enlarged head from each web and said portion remains joined at the base of said shank to the associated web.
2. Apparatus as claimed in claim 1 /that said anvil opening and said punch are of substantially the same shape, characterised in

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said punch projects a given distance from said punching head and terminates in a web-contacting surface, a first part of said web-contacting surface is delineated by said second sharp edge to comprise said shank region and said 5 enlarged head region and a second part of said web-contacting surface forms an extension from said shank region and tapers away from said first part towards said punching head, said first and second part having a junction which is not sharp.

2 characterised in that

3. Apparatus as claimed in claim 1 or claim/said anvil 10 has an upper surface, said opening is formed through said surface and comprises a first part defined by said first sharp edge and a second part forming an extension of said shank region remote from said enlarged head region, said second part having a lower wall which tapers upwardly to 15 join said upper surface.

preceding claims characterised in that

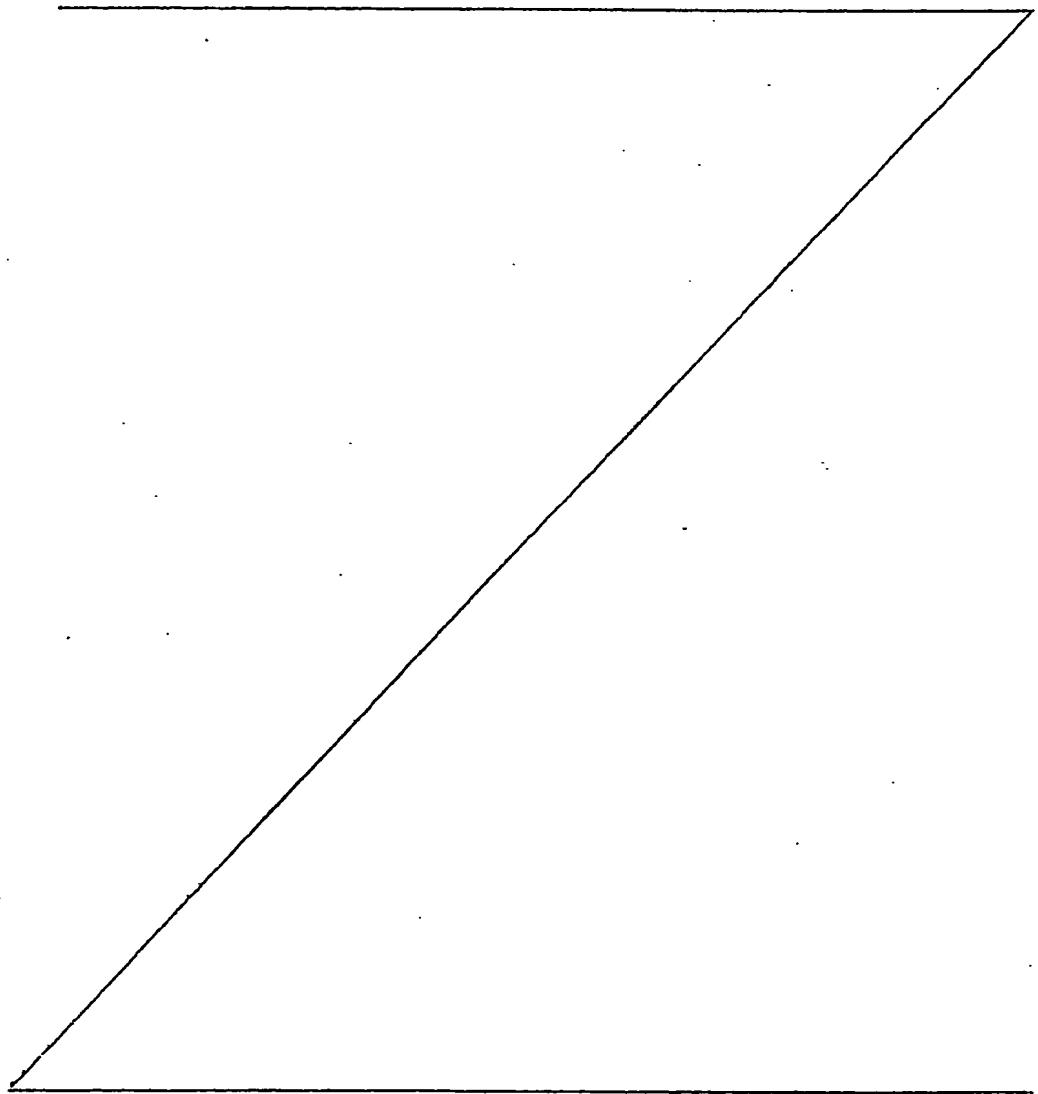
4. Apparatus as claimed in any of the / said punch is wholly delineated by said second sharp edge and said anvil opening comprises a first part defined by said first sharp edge and a second part forming an extension of 20 said shank region remote from said enlarged head region.

preceding claims characterised in that

5. Apparatus as claimed in any of the / a plurality 25 of similar openings are incorporated in said anvil and a plurality of similar punches are incorporated in said punching head, each one of said punches having a delineated part capable of fitting closely within a defined part of a respective one of said openings.

- 3 -

6. Apparatus as claimed in any of the preceding claims, characterised in that the apparatus further comprises guide means operative, as part of said webs are advanced into said apparatus, to fold said
5 advancing parts back over the remainder of said webs and to position said folded-back parts and part of the remainder of said webs over said anvil opening.
-



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characterised in that the

7. Apparatus according to any of claims 1 to 5/
apparatus including a base, a punching head slidable
relative to the base, a handle mounted on the base
for pivotal movement relative thereto and a folding
mechanism mounted on the base for pivotal movement
thereto, the handle, the punching head and folding
mechanism being operably connected together so that
movement of the handle causes both the folding
mechanism and the punching head to effect their
pivotal movements.

10 characterised in that said
8. Apparatus according to any of claims 1 to 6/
mounting means comprises a pivotal connection between
said base and said punching head located remote from
said anvil opening and punch. characterised in that said

15 9. Apparatus as claimed in any of claims 1 to 5/
mounting means comprises guiding means for guiding
said punching head along a reciprocal path towards
and away from said base. characterised in that the

10. Apparatus according to any of claims 1 to 5/
20 apparatus includes means for feeding continuous sheets
of paper, each continuous sheet having spaced-apart
holes along the margin thereof, means for superimposing
said continuous sheets, means for punching portions of
material through said superimposed continuous sheets
25 at spaced-apart positions therealong, means for
displacing at least one of said continuous sheets
relative to the other or others and means for
separating the continuous sheets into sets of
superimposed shorter sheets, so that each set has been
30 subjected to at least one hole punching operation
whereby the sheets of each set are joined together.

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FIG. 1.

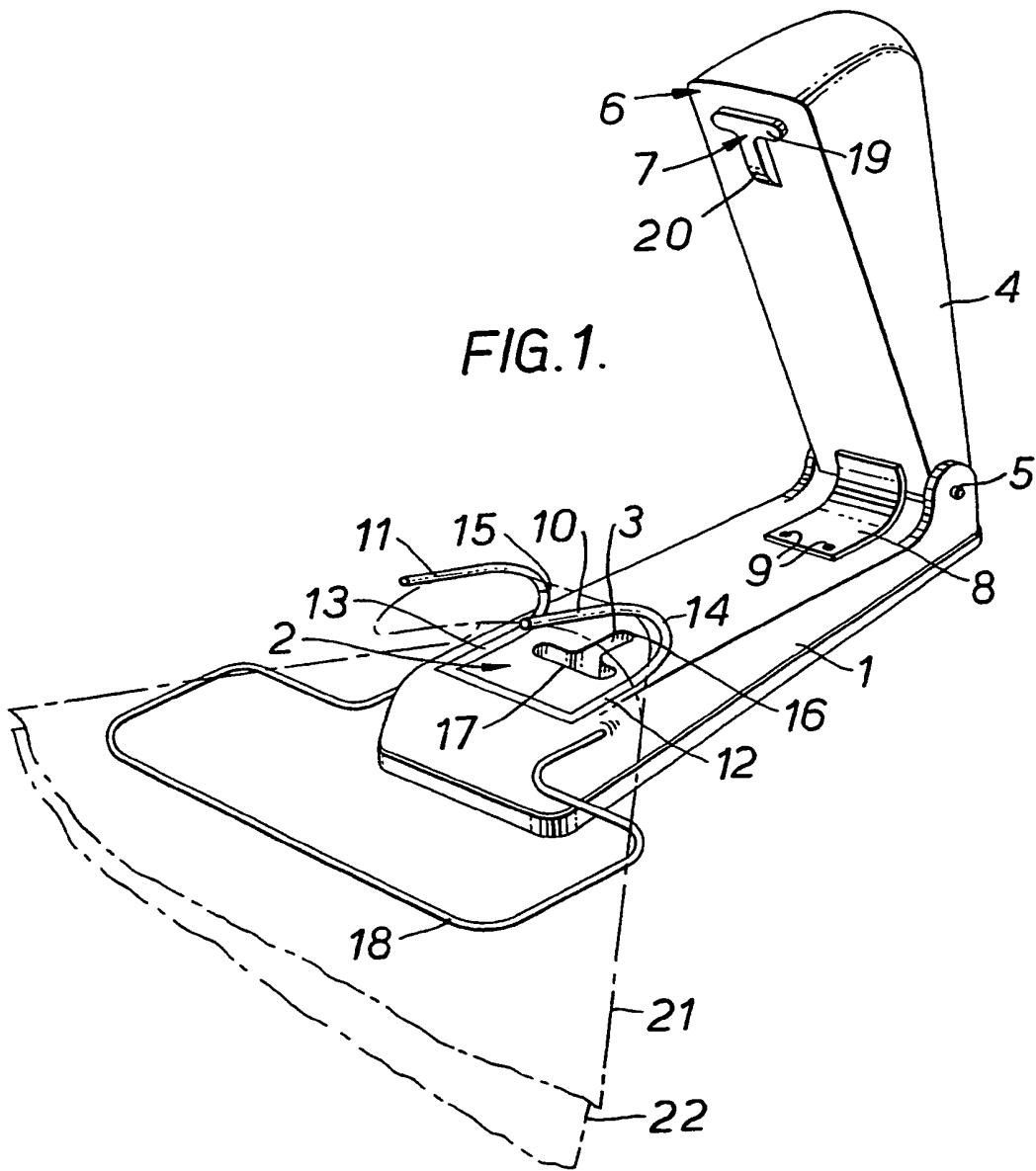


FIG.2.

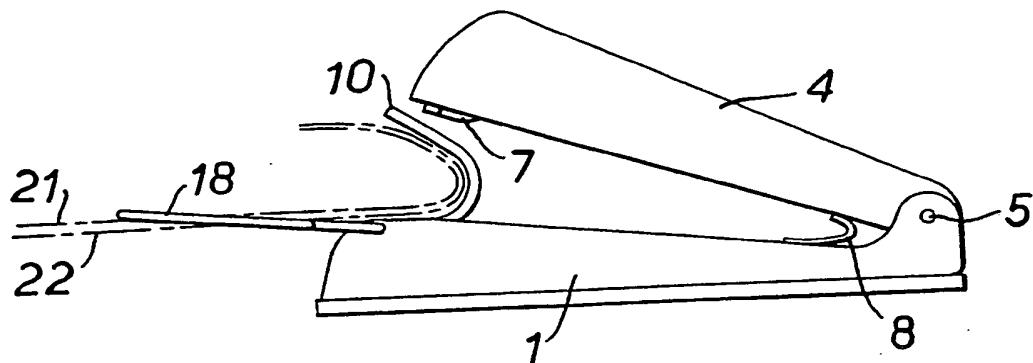


FIG.3.

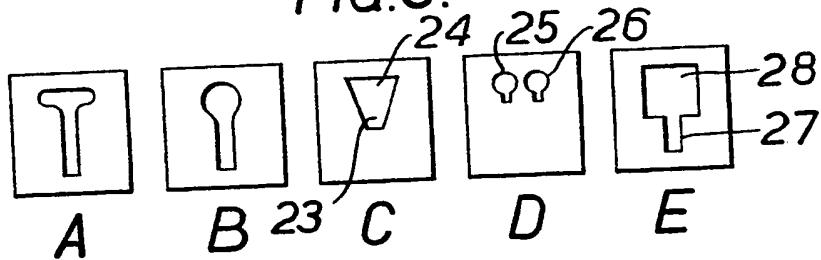


FIG.4.

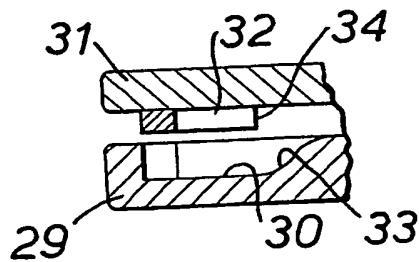


FIG.5.

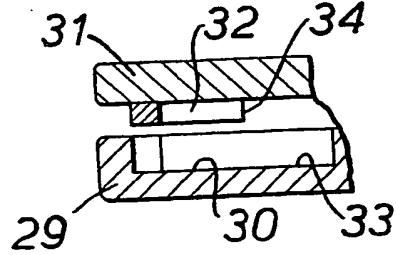


FIG.6.

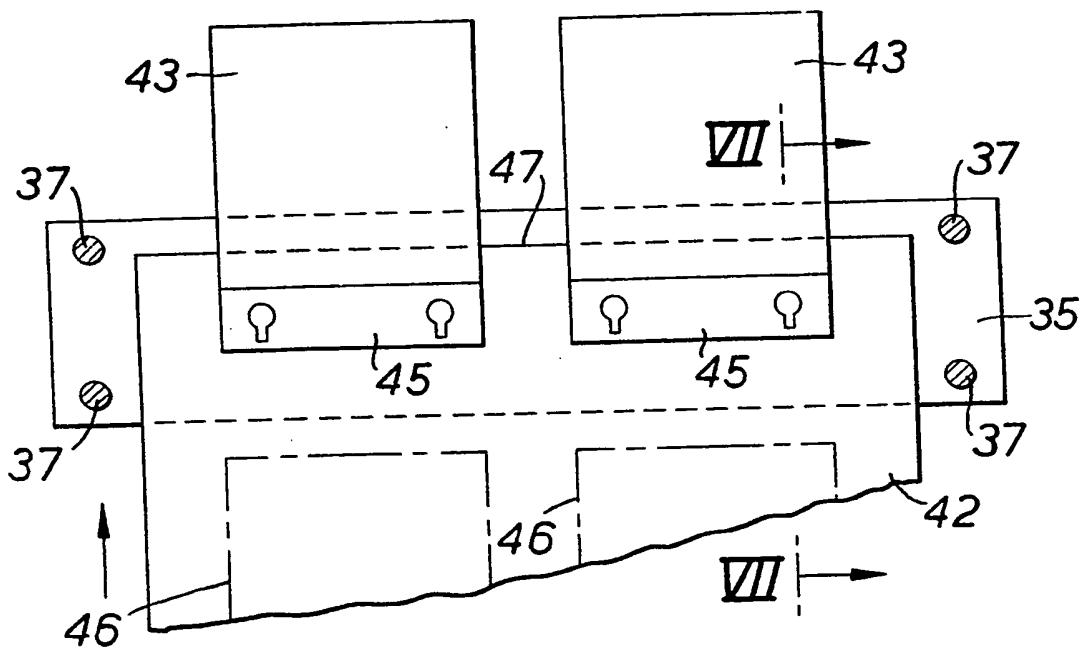


FIG.7.

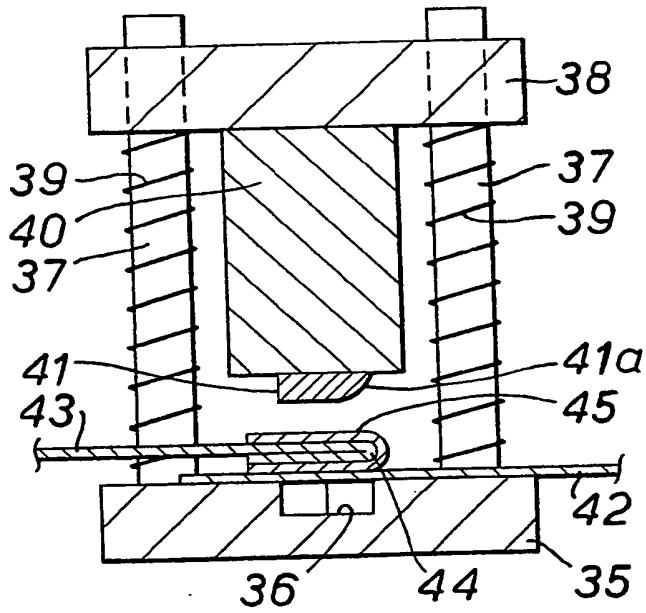


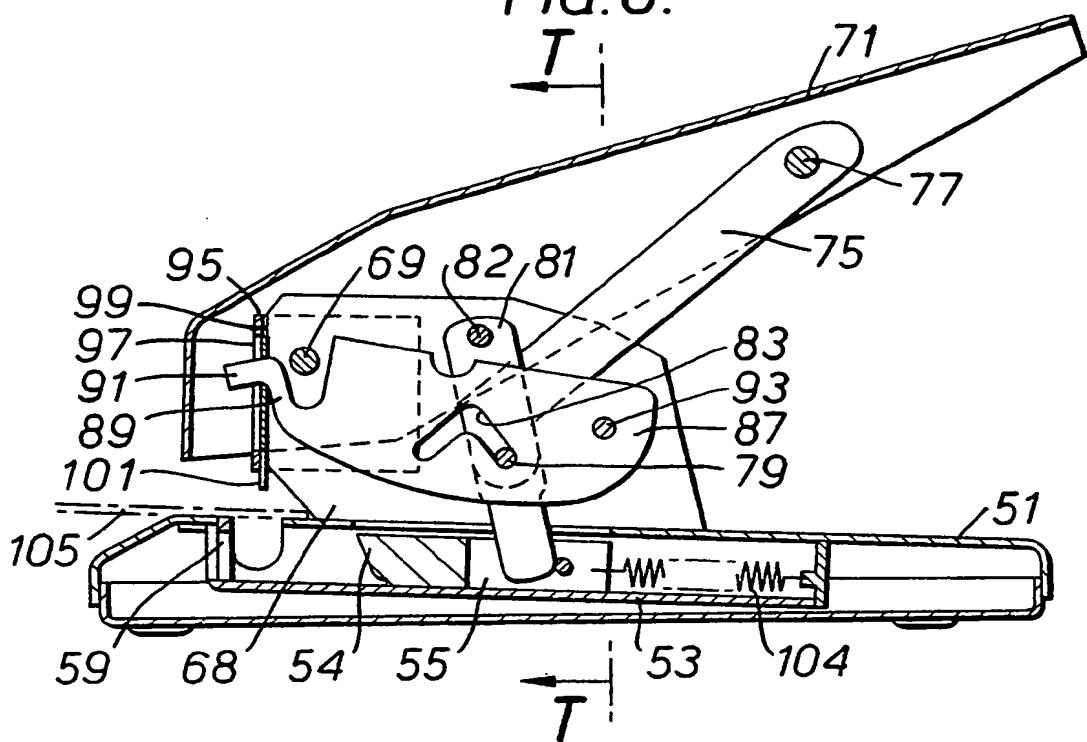
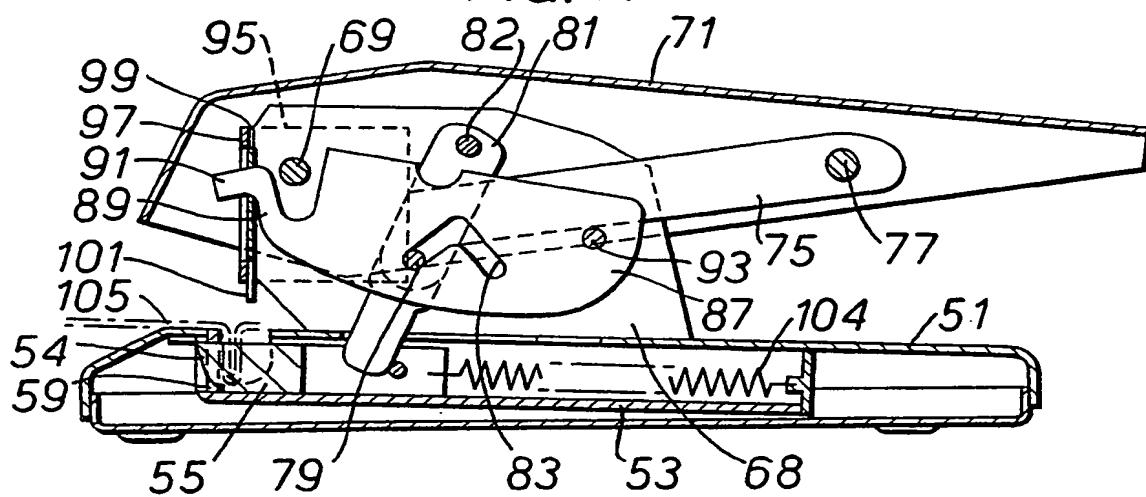
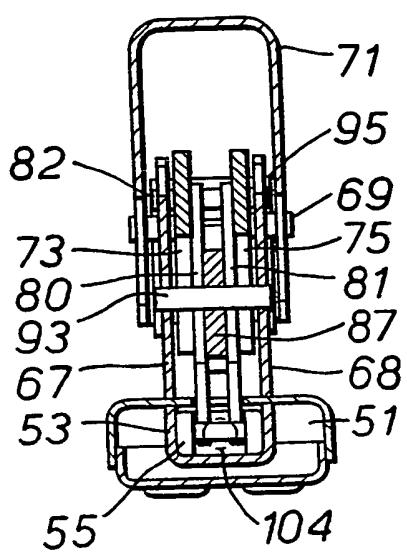
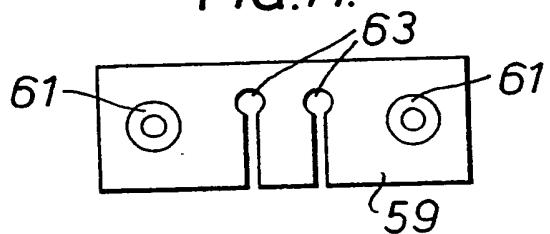
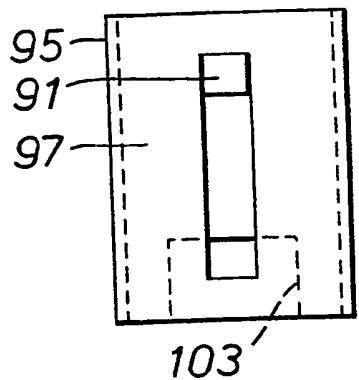
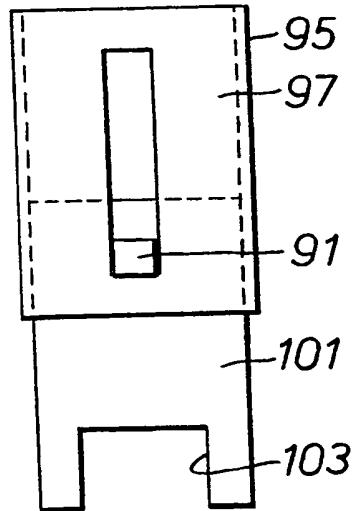
FIG. 8.**FIG. 9.**

FIG.10.**FIG.11.****FIG.12.****FIG.13.**

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Application number

EP 80 30 0596

DOCUMENTS CONSIDERED TO BE RELEVANT		CLASSIFICATION OF THE APPLICATION (Int. Cl. *)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim
	<p><u>US - A - 3 741 079</u> (BOSSONS et al.) 1 * Whole document *</p> <p>--</p> <p><u>US - A - 1 980 154</u> (COE) 1-4 * Whole document *</p> <p>--</p> <p><u>US - A - 2 083 538</u> (AFFELDER) 1,5 * Whole document *</p> <p>--</p> <p><u>FR - A - 906 424</u> (HAGER) 1-5,7 * Whole document *</p> <p>--</p> <p><u>GB - A - 1 049 223</u> (GUTHERIE WILLIAM GIFFORD) 1,10 * Whole document *</p> <p>--</p> <p><u>DE - A - 1 436 082</u> (GOEBEL) 1,10 * Whole document *</p> <p>--</p> <p><u>GB - A - 792 852</u> (HOWARD J. JEWELL) 1 * Whole document *</p> <p>--</p> <p><u>GB - A - 508 663</u> (HAHN) 1 * Whole document *</p> <p>--</p>	1 1-4 1,5 1-5,7 1,10 1
<input checked="" type="checkbox"/> The present search report has been drawn up for all claims		TECHNICAL FIELDS SEARCHED (Int.Cl. *)
		B 42 F B 31 F B 21 D
<input checked="" type="checkbox"/> X		CATEGORY OF CITED DOCUMENTS
X: particularly relevant A: technological background O: non-written disclosure P: intermediate document T: theory or principle underlying the invention E: conflicting application D: document cited in the application L: citation for other reasons &: member of the same patent family, corresponding document		
Place of search The Hague		Date of completion of the search 24-04-1980 Examiner MEULEMANS

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Application number

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
D	<u>US - A - 1 065 904</u> (BUMP) * Claims 1-5 * -- <u>FR - A - 2 144 140</u> (CIBIE PROJEC- TEURS) * Claims * -- <u>CH - A - 494 131</u> (GOEBEL) * Whole document * -- <u>US - A - 3 577 575</u> (FUMIO TANIGU- CHI) * Whole document * -----	1	
A		1	TECHNICAL FIELDS SEARCHED (Int. Cl. 3)
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